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(56) Documents Cited
GB 2334042 A **GB 2321654 A** **GB 2237825 A**

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INT CL^7 **E03D 9/052**
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(54) Abstract Title
Apparatus for ventilating a water closet

(57) Apparatus for use in extracting air or other vapours from a lavatory pan of the type having an associated cistern with a siphon, comprising an air extraction pipe (12) adapted to be connected at one end to the siphon delivery pipe, and air extraction means (15) connectable to the other end of the air extraction pipe, and means for varying the rate of flow of air along the air extraction pipe in operation on of the air extraction means.

The flow varying means suitably comprises a control box (22) to regulate either the pitch of the fan blades or the fan motor speed, or a butterfly valve arrangement (23).

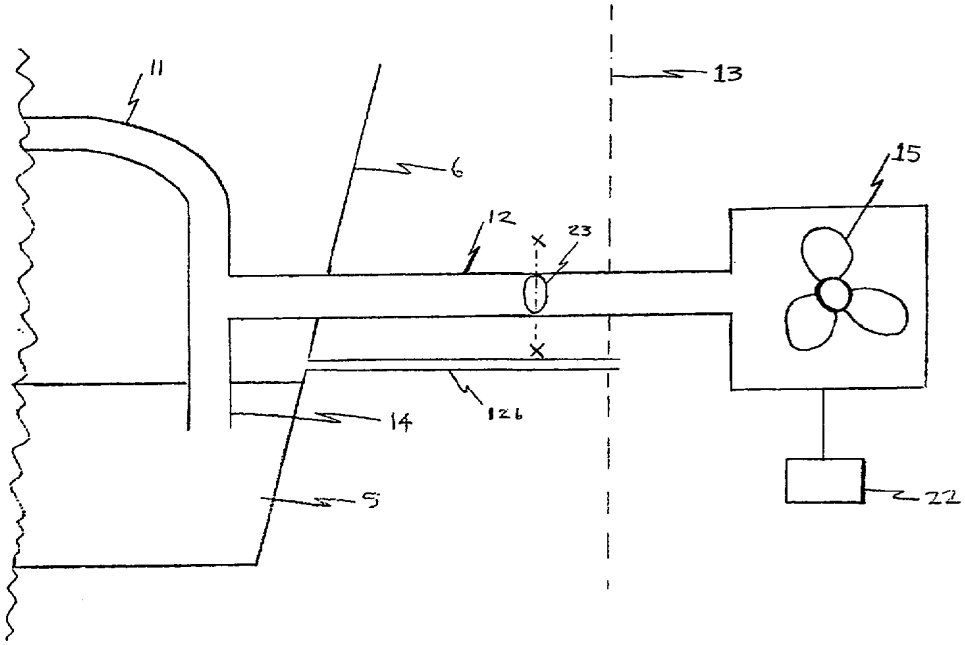

FIG 2

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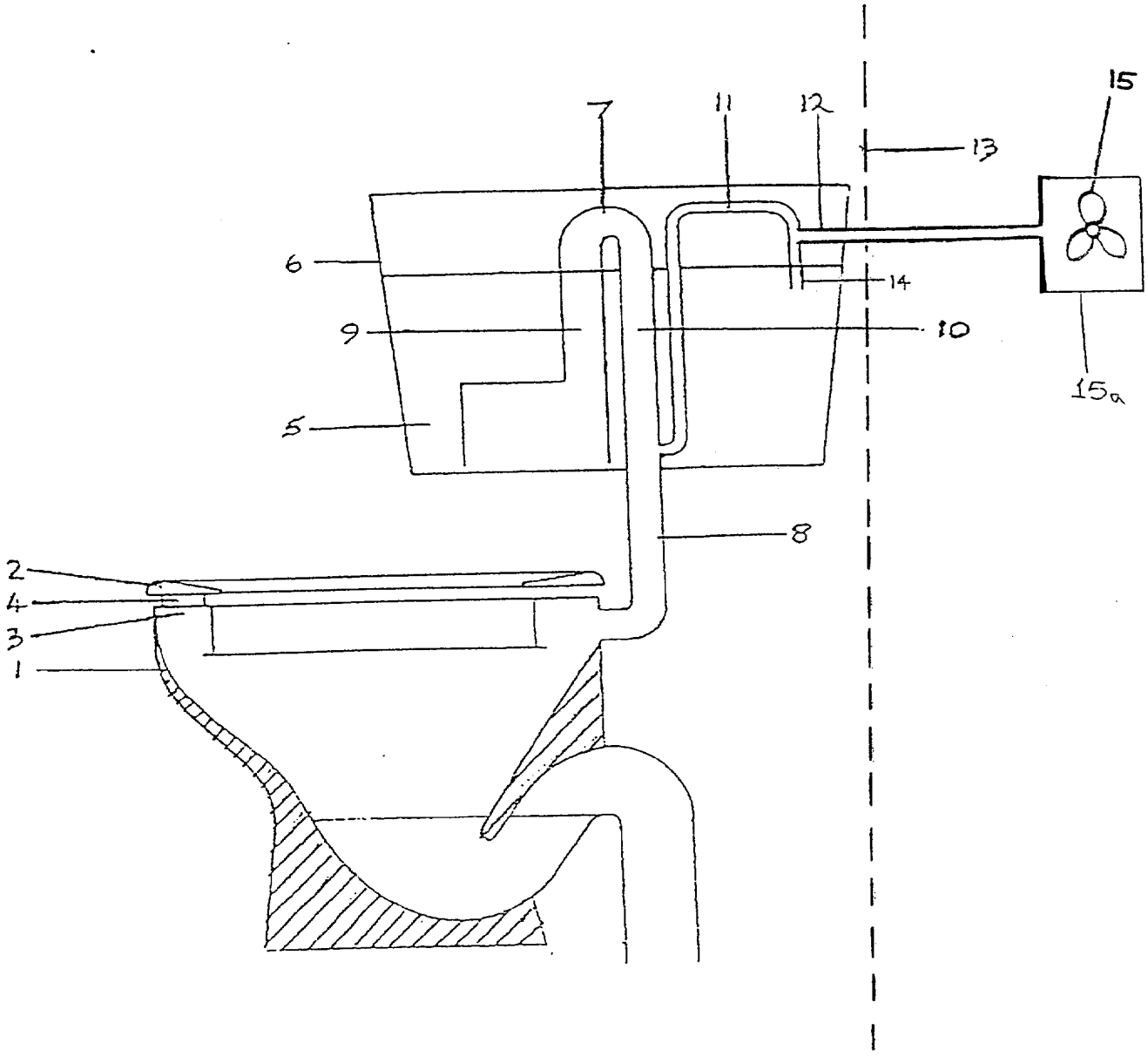

FIG 1

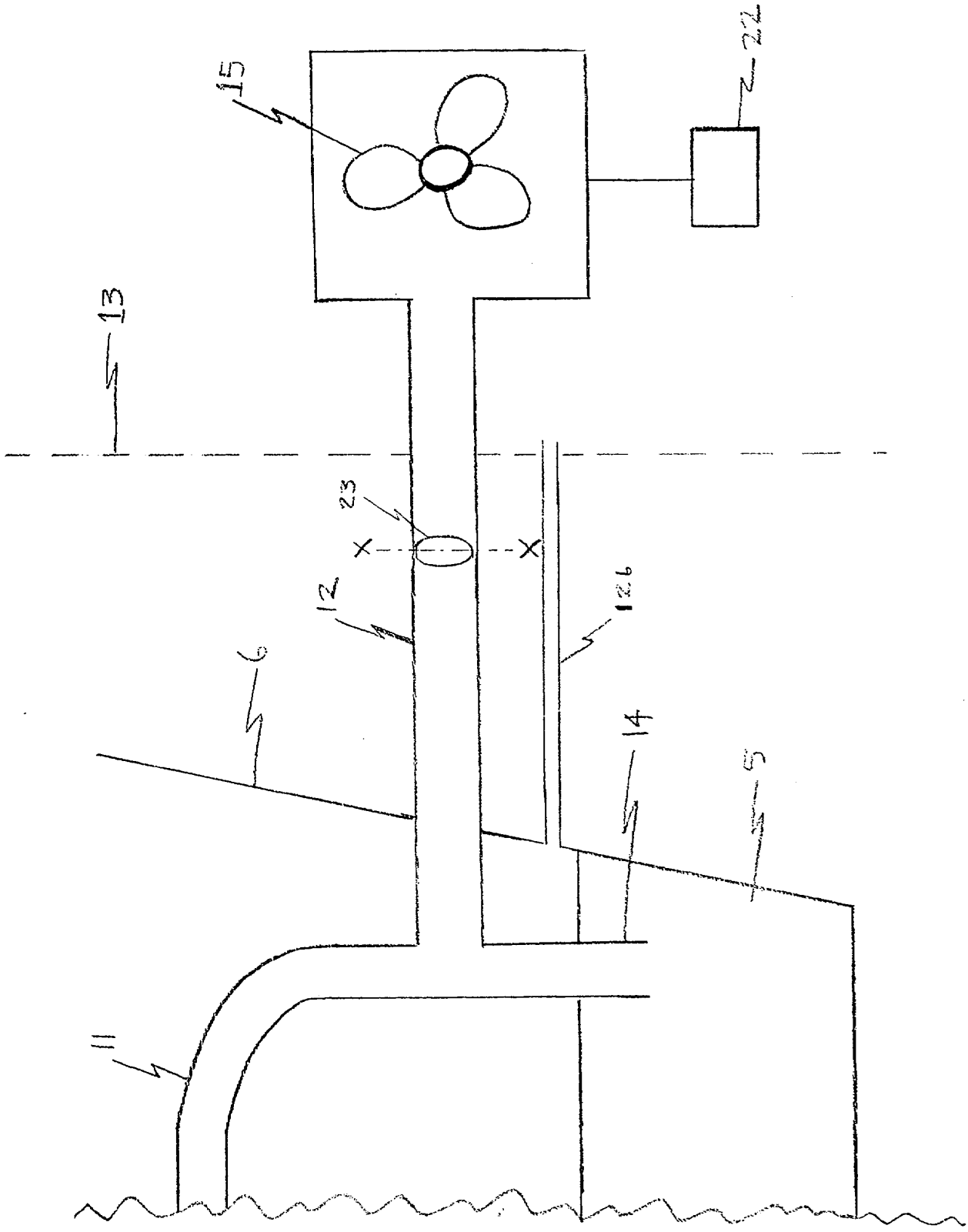

FIG 2

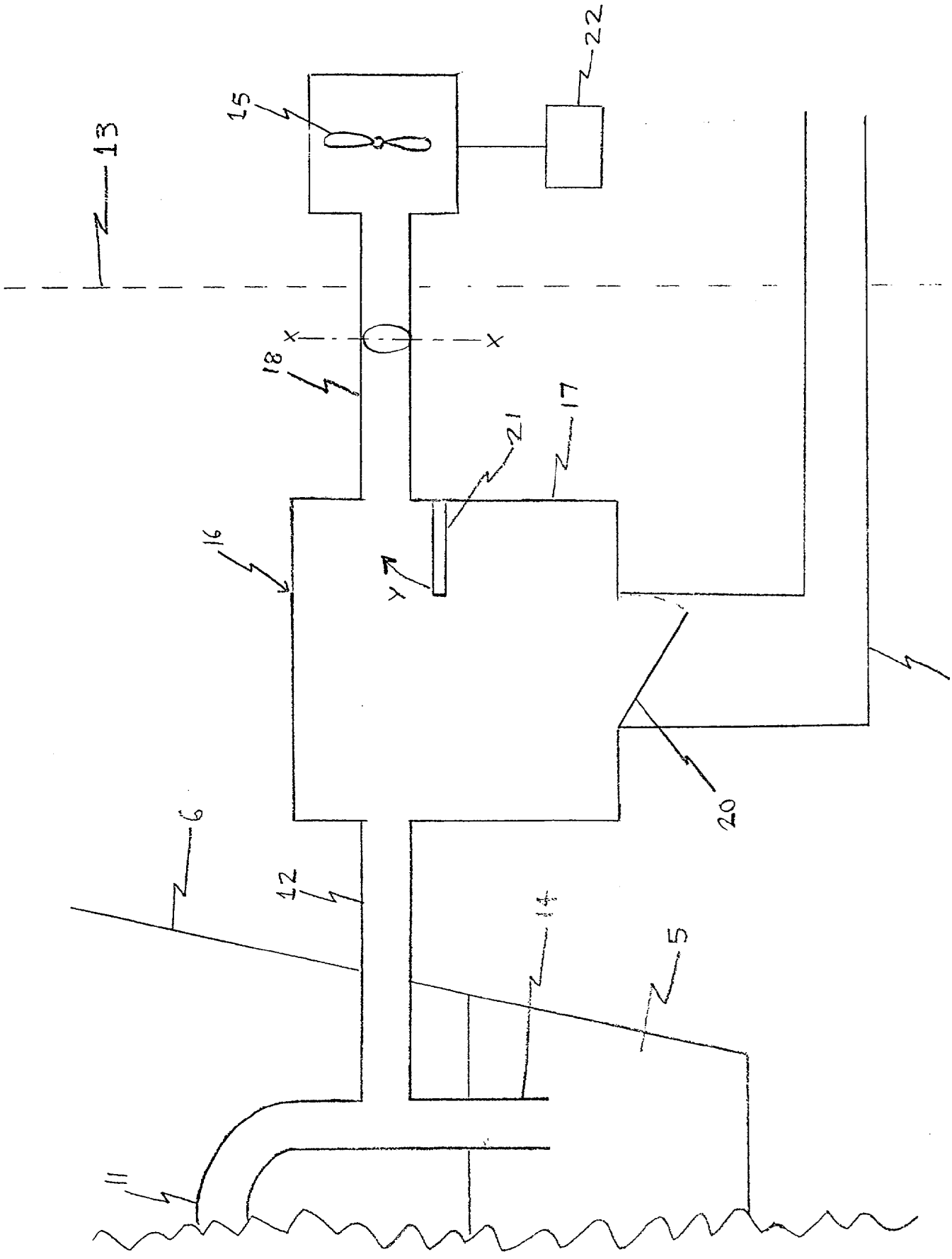

FIG 3

VENTILATED SANITARY WARE FOR A WATER CLOSET

This invention relates generally to the ventilation of a water closet, and in particular to improved ventilated sanitary ware for a water closet.

Building regulations require water closets to have adequate ventilation, preferably direct to the outside. In circumstances where it is absolutely impossible for direct ventilation to the outside it is allowable to have forced ventilation by means of a fan and a duct leading to the outside. Typically the fan is linked to a light switch so as to be energised at all times that the water closet is occupied. This works to some extent in removing air contaminated with unpleasant odours from the room, but this can only be a partial solution in that what is really required is some means for preventing the odours from diffusing into the room in the first place.

The present invention is concerned therefore with extracting odours, created when the water closet is used, directly from the water closet sanitary ware itself. Two common methods involve modifying either the lavatory pan seat or the lavatory pan itself in order to provide extraction airways. This involves replacement of the sanitary ware since such devices cannot be retrofitted. The present invention seeks to make use of the conduit through which flushing water reaches the pan to provide

a ready made initial part of an odour extraction route.

As is well known, apart from the so-called "victoria" valves which act by timed self-closing action, flushing water normally reaches a water closet pan from a cistern in a typical arrangement by the action of a siphon. The outlet leg (hereinafter also referred to as the flushing pipe) of such a siphon is open to the atmosphere where it exits into the pan and is effectively sealed at its other end by the water in the water closet cistern. Therefore if the air in the flushing pipe were to be extracted from a point anywhere along its length other than where it exits into the pan replacement air would have to flow into the flushing pipe from the pan itself.

However, the result of joining an extracting airway to the flushing pipe is that the extracting airway will allow air (atmospheric air) to flow into the pipe at this point, which may be disadvantageous. The pressure of water (or siphon head) which drives the flushing effect is related directly to the distance between the top of the water in the inverted loop of the siphon pipe and the point at which the flushing pipe is open to the atmospheric pressure. Thus the siphonic effect is reduced by the action of joining an airway to the flushing pipe as just described.

One approach to this problem, utilising a one-way valve

is shown in GB 2,182,368. However, there are a number of practical difficulties with such an arrangement. If the one-way valve allows air to leak into the outlet leg of the siphon, then the siphon action is destroyed. Also, the bias towards closure of the valve has to be sufficient to prevent water escaping into the overflow pipe during the flushing operation, yet also to be small enough to be overcome by the suction effect of an extraction fan at the end of the foul air extraction passage. This is difficult to achieve. Furthermore, in order to ensure that the one-way valve is shut when the water closet is flushed, some switch connection must be made between the power supply to the extractor fan and the water closet flush operating. Thus, in practice the system disclosed in GB 2,182,368 is cumbersome, with a number of points at which failure can occur.

GB 2,209,356 shows another attempt at solving the problem of extracting foul air from a lavatory pan. In the arrangements shown, a connection is made between the siphon outlet tube at the point at which it leaves the cistern and an extraction fan which is situated inside the cistern but above the level of an overflow pipe. The extraction fan exhausts through a second pipe through the wall of the cistern. The extraction fan exhaust pipe includes a T-piece to which a dip tube is also attached. Thus the extraction fan exhaust pipe also acts as an overflow pipe. However, the proximity of the junction

between the extraction fan exhaust pipe and the dip tube to the exhaust fan means that if the ball-cock should fail, as they often do, water could enter the exhaust fan chamber. Also the leads to the extraction fan could become submerged. This, clearly, is undesirable. In addition, as the extraction fan will be running during a flushing operation, there will be a tendency for water to be sucked up the inlet pipe to the extraction fan chamber. Again, this is an entirely undesirable state of affairs.

The present invention seeks to provide an improved water closet air extraction system, particularly intended for short term operations to extract foul air quickly from a region in and around lavatory bowls in order to prevent it from diffusing into the room.

In some systems fitted to existing installations the air extraction pipe may be separate from the cistern and forms part of the cistern overflow discharge pipe. The existing overflow pipe is retained and remains functional. Except when water is flushed into the toilet bowl, the level of flushing water in the cistern will be close to the opening to the overflow pipe. The result is that even with moderate air flow in the overflow pipe water will be sucked into the pipe and travel towards the air extraction means. In such cases it is important to separate any overflow water from the cistern from

extracted air removed from the toilet bowl and to prevent the water from entering the extraction means.

GB2321654 discloses a system for reducing the likelihood of overflow water entering an extractor fan. The fan is located at the end of the overflow pipe, preferably above it. At the end of the overflow pipe but before the fan the water drops down into a container whilst the air continues to the fan. The container has a unidirectional valve that opens when there is sufficient weight of water above it.

Differences in the specific arrangement and dimensions of the components in different toilet systems result in different air flow rates being created within the overflow pipe for a given extractor fan speed so that different levels of suction acting to draw water from the cistern may result.

In systems where the air flow rate is below that which may draw water into the fan the system is not removing as much air from the toilet bowl as is possible. In systems where the air flow rate is above that which may draw water into the fan this may prevent its use. Use of a waterproof fan system with a sealed motor may be possible although this is likely to be expensive.

The present invention seeks, therefore, to provide an

improved water closet air extraction system, overcoming the problems of the prior art identified above.

The basis for the present invention is a sealed air extraction route created from the down pipe of a siphonic flush toilet to a standard overflow pipe through the use of interconnecting pipes and preferably without the use of valves or moving parts that might fail.

The system is preferably so arranged that the overflow function is maintained and water overflowing from a cistern flows freely away from the siphonic flushing unit. All of the pre-existing components and functionality of the toilet system may be retained.

According to a first aspect of the present invention there is provided sanitary ware for a water closet including a cistern containing a siphon having an outlet communicating with a lavatory pan, an air extraction pipe communicating with the siphon outlet and air extraction means, the air extraction means being situated outside the cistern and the air extraction pipe communicating directly with the air extraction means, in which there are provided flow adjustment means for adjusting the rate of airflow within the said air extraction pipe or at least a part thereof.

The air extraction means may therefore initially be tuned

to match the components of the toilet system to provide maximum efficiency of air extraction whilst ensuring that no water enters the air extraction means, and is preferably adjustable thereafter.

The air extraction means preferably comprise a fan although other means, such as a vacuum pump, are not beyond the scope of the invention.

In some embodiments the extraction device may further comprise separation means positioned upstream of the air extraction means for separating overflow water that passes along the overflow discharge pipe from extraction air. In a preferred embodiment the separation means comprise a water trap; the water trap may include valve means for releasing trapped water. The valve means may comprise a one-way flap valve that is biased to a closed position.

In view of the importance of preventing damage to the fan a negative feedback loop mechanism may be used to turn off the fan if its suction overloads the gravity based air/water separator. Therefore there may further be provided negative feedback means for inactivating the air extraction to prevent the approach of overflow water thereto.

The negative feedback may be provided by way of a float

valve which controls the fan, whereby if the water level within the water trap exceeds a predetermined level the float valve turns off the fan until the water level decreases. This is important if, for example, the flap valve malfunctions or if the volume of water entering the water trap overloads the flap valve.

Variation of the extracting air flow may be achieved in a number of ways including, without limitation, varying the fan speed, varying the pitch of fan blades, or varying the cross sectional area of the air extraction airway which might be achieved using a butterfly valve.

Preferably the entrance to the air extraction pipe is as low as is practicable in relation to the cistern.

According to a second aspect of the present invention there is provided apparatus for use in extracting air or other vapours from a lavatory pan of the type having an associated cistern with a siphon, comprising an air extraction pipe adapted to be connected at one end to the siphon delivery pipe, and air extraction means connectable to the other end of the air extraction pipe, and means for varying the rate of flow of air along the air extraction pipe in operation on of the air extraction means.

Various embodiments of the invention will now be more

particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic cross-section schematically illustrating the basic components of a water closet into which the present invention may be fitted;

Figure 2 is a magnified view of the region of the fan of Figure 1 illustrating an arrangement for preventing water entering the fan of Figure 1; and

Figure 3 is a magnified view of the region of the fan of Figure 1 illustrating a further arrangement for preventing water entering the fan of Figure 1.

Referring first to Figure 1, the basic components of a water closet to which the present invention may be fitted are illustrated. A pan 1 has a seat 2 which is raised above the upper rim 3 of the pan 1 by a number of pads 4; thus, even when a person is seated on the pan 1, air from the room within which the water closet is contained can pass into the pan 1 of the water closet. Flushing water 5 is stored in a cistern 6 from which it flows under siphonic action via a siphon 7 and flushing pipe 8 into the water closet pan 1. The siphon 7 has an inlet leg 9 and an outlet leg 10. A foul air extraction airway 11 is connected and sealed to the siphon outlet leg 10, and joins with a conventional overflow pipe 12 which passes through a wall 13 of the room in which the water closet is situated. The overflow pipe 12 includes a dip

tube 14 the open end of which is below the level of the flushing water 5. A foul air extraction fan 15 and housing 15a are attached to the end of the overflow pipe 12. The path from the end of the dip pipe 14 to the siphon outlet leg 10 includes a portion which is higher than any part of the portion of the overflow pipe 12 from the junction with the dip pipe 14 to the termination of the overflow pipe 12 so that in the event of a failure of a ball-cock water valve (not shown) which controls the flow of the flushing water 5 to the cistern 6 the excess water flows away from the flushing pipe. The design of the housing 15a may be such that water flowing along the pipe 12 in such circumstances is directed to the exterior without flowing through electrical parts of the fan 15. Preferably, however the arrangement of the foul air extraction apparatus should be such that, in the event of an overflow arising, the overflow water does not come into contact with any part of the fan 15.

In the arrangement shown in Figure 1, the foul air extraction fan 15 and housing 15a are outside the room in which the water closet is situated. This has the advantage that no power supply for the foul air extraction fan has to be provided within the room in which the water closet is situated. It is also possible for the fan to be rotated by outside air movements or the convention currents between a warmer interior and a cooler exterior. However, the foul air extraction fan 15

can be positioned at any convenient position in the overflow pipe 12 between the wall of the cistern 6 and the termination of the overflow pipe 12.

Referring now to Figure 2 there is shown a magnified view of the region of the fan 15 shown in Figure 1, to illustrate arrangements for preventing water from entering the fan 15.

Operation of the fan 15 draws air from the toilet pan 1, through the foul air extraction airway 11 and then through the existing overflow pipe 12 before exiting through the fan 15.

An additional overflow pipe 12b is installed in the cistern 6 at a level lower than the existing overflow pipe 12. This avoids water entering the overflow pipe 12 in the case of a rise in the level of water in the cistern and maintains a normal overflow function as water flows along the pipe 12b in preference to the pipe 12.

However, if the airflow in the existing overflow pipe 12 is too great water 5 will be drawn up the dip tube 14 and into the fan 15. If the airflow is too low the efficiency of air extraction is lowered.

The airflow is therefore adjusted to tune it to match the existing components of the water closet, to help prevent

water entering the fan 15 whilst allowing maximum airflow for efficient extraction.

The fan 15 may, therefore, be linked to a control box 22. The airflow created by the fan 15 is adjustable using the control box 22 to regulate either the pitch of the fan blades (in the case of an axial fan) or the fan motor speed.

As an alternative a butterfly valve arrangement comprising a flat disc 23 may be used to occlude more or less of the overflow pipe 12 by turning the disc 23 about pivot axis X, whereby to adjust the airflow in the pipe 12.

Referring now to Figure 3 there is shown a magnified view of the region of the fan 15 of Figure 1 to illustrate a further arrangement for preventing water from entering the fan 15. In this embodiment the flow control means illustrated in Figure 2 are present and serve to prevent water being sucked into the overflow pipe 12 and to tune the system as discussed above; however there is no requirement for an additional overflow pipe 12a and the overflow pipe 12 remains functional to accept overflow water.

At the end of the overflow pipe 12 remote from the dip tube 14 is a water trap generally indicated 16. The

water trap 16 is positioned in line between the overflow pipe 12 and the fan 15 via a fan pipe 18 and comprises a container 17 that is in fluid connection with both.

The container 17 is also connected to a discharge pipe 19; at the entrance to the discharge pipe 19 is a normally-closed unindirectional flap valve 20. A float valve 21 is located in the container 17 at a position below the level at which the fan pipe 18 joins the container 17.

In use water may enter the overflow pipe 12 due to, for example, an overflow or if the airflow in the overflow pipe 12 is such that water is sucked up the dip tube 14 and into the overflow pipe 12. A water/air mix travels along the overflow pipe 12 until it reaches the water trap 16 whereupon gravity pulls the water into the container 17 whilst air passes through and out of the container 17 via the fan pipe 18.

Water builds up in the container 17 until there is sufficient weight to push open the flap valve 20 whereupon water is released through the discharge pipe 19, providing a visual indication that water is in the overflow pipe 12.

If the flap valve 20 malfunctions or the amount of water drawn into the container exceeds that which can be

discharged via the discharge pipe 19 the level of water in the container 17 will rise towards the level at which the fan pipe 18 is connected thereto. However, before water reaches this level the float valve 21 is pushed up in the direction shown by arrow Y which in turn shuts off the fan 15 whereby to slow down or stop the flow of water into the container 17. The fan 15 will only restart when the float valve 21 returns to its original position. In this way the float valve 21 constitutes a negative feedback means.

In this embodiment, where a butterfly valve arrangement 23 is used, it is positioned upstream of the water trap 16 in the fan pipe 18 in preference to being positioned in the overflow pipe 12, so as not to reduce the cross-sectional area of the overflow pipe 12 along which overflow water runs.

CLAIMS

1. Sanitary ware for a water closet including a cistern containing a siphon having an outlet communicating with a lavatory pan, an air extraction pipe communicating with the siphon outlet and air extraction means, the air extraction means being situated outside the cistern and the air extraction pipe communicating directly with the air extraction means, in which there are provided flow adjustment means for adjusting the rate of airflow within the said air extraction pipe or at least a part thereof.

2. Sanitary ware as claimed in Claim 1, in which the air extraction means comprise a fan.

3. Sanitary ware as claimed in Claim 1 or Claim 2, further comprising separation means positioned upstream of the air extraction means for separating overflow water that passes along the overflow discharge pipe from extraction air.

4. Sanitary ware as claimed in any of Claims 1 to 3, in which the said separation means include a water trap.

5. Sanitary ware as claimed in Claim 4, in which said water trap includes valve means for releasing trapped water from said water trap.

6. Sanitary ware as claimed in claim 5, in which said valve means comprise a flap valve.

7. Sanitary ware as claimed in any preceding claim, further including negative feedback means for inactivating the said air extraction means whereby to prevent the approach of overflow water thereto.

8. Sanitary ware as claimed in Claim 7, in which said negative feedback means comprise a float-valve positioned within the said water trap.

9. Sanitary ware as claimed in any preceding claim, in which the said flow adjustment means comprise a variable speed motor for driving said air extraction means.

10. Sanitary ware as claimed in any preceding claim, in which the said flow adjustment means comprise a fan having a plurality of blades, the pitch of said blades being variable.

11. Sanitary ware as claimed in any preceding claim, in which the said flow adjustment means comprise obstruction means for varying the effective dimensions of the said air extraction pipe.

12. Sanitary ware as claimed in Claim 11, in which the said obstruction means comprise a butterfly valve.

13. Apparatus for use in extracting air or other vapours from a lavatory pan of the type having an associated cistern with a siphon, comprising an air extraction pipe adapted to be connected at one end to the siphon delivery pipe, and air extraction means connectable to the other end of the air extraction pipe, and means for varying the rate of flow of air along the air extraction pipe in operation on of the air extraction means.

14. Sanitary ware substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

15. Apparatus for use in extracting air or other vapours from a lavatory pan as hereinbefore described with reference to, and as shown in, the accompanying drawings.

Application No: GB 0011131.0
Claims searched: 1-13

Examiner: D. Haworth
Date of search: 23 November 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): E1C (C38)

Int Cl (Ed.7): E03D 9/052

Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2321654 A (Harding)	1 and 13 at least
Y	GB 2334042 A (Corfield)	1 and 13 at least
Y	GB 2237825 A (Maloney)	1 and 13 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.